Distributed Transition Edge Sensor Arrays with Kinetic Inductance Readout

Completed Technology Project (2016 - 2018)

Project Introduction

Technology development program to produce focal plane arrays (FPA) for Far-Infrared (FIR) band instruments operating on a cryogenically cooled space telescope. In particular these detector arrays would be used to produce images in the wavelength bands from ~50 - 1000 microns.

The goal of this project is to develop a frequency domain multiplexed (FDM) FPA based on a electron-phonon isolated superconducting transition edge sensors (ep-TES) coupled to kinetic inductance based readout that is highly multiplexable. High sensitivity detector technology in the FIR is based on cryogenically cooled detectors, typically operating at <1.0K and quite often sub-Kelvin. Semiconductor readouts either do not operate at these temperatures or are to energy inefficient for the available cooling power and other, lower power, readout techniques must be used. Frequency domain multiplexing (FDM) is a powerful technique now under development that has the potential to produce large pixel count, high-sensitivity arrays throughout the FIR when mated with compatible sensors.

Anticipated Benefits

The Decadal Review process is currently underway for the upcoming decade. A potential cornerstone mission is the Origins Space Telescope, a cryogenically cooled space telescope operating in the FIR. The detectors being developed under this project are targeting the detector requirement for this mission. Because of the decade-plus development cycle for such detectors, the detector research must be done far in advance of the mission.

FPAs with the sensitivity required for FIR astronomy in space are of little value for higher background observations, however the frequency domain techniques may be applicable to a broad range of applications.

The nonlinear kinetic inductance effect used in the readout portion of this FPA is directly applicaple to other areas of interest to NASA and other Government agencies, in particular, in the development of quantum limited parametric amplifiers.

JPL_IRAD_Activities Project

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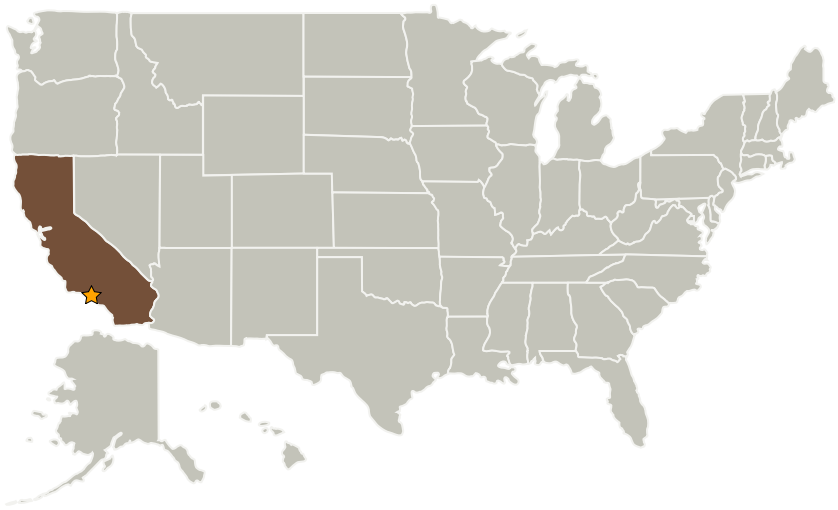
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations
California

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:

Fred Y Hadaegh

Project Manager:

Fred Y Hadaegh

Principal Investigator:

Henry G Leduc

Co-Investigator:

Peter K Day

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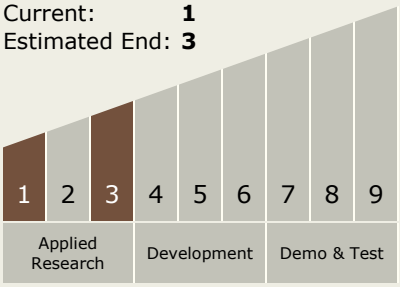
Images

JPL_IRAD_Activities Project Image
JPL_IRAD_Activities Project
(https://techport.nasa.gov/image/27868)

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Foundational Knowledge

Supported Mission Type

Push